



Environmental & Civil Engineering Services

Engineering ♦ Geotechnical ♦ Testing

Inter-Basin Transfer Permit Application

To: Mr. Jim McAdoo
TDEC-Water Pollution Control Division
6th Floor, L & C Annex
401 Church Street
Nashville, Tennessee 37243-1534

Project: City of Crossville Water System
Inter-Basin Transfer Application for Permit

Subject: Permit Request for Grandfathered Inter-Basin Activity:
Upper Cumberland River Basin into Upper Tennessee -Clinch/Emory River Basin

Date: December 15, 2009

The City of Crossville is requesting an inter-basin transfer permit from the Tennessee Department of Environment and Conservation for up to a total of 3.5 MGD from the Upper Cumberland River Basin to the Upper Tennessee -Clinch/Emory River Basin.

The permit fee for inter-basin transfer permit applications is \$250 per 125,000 gpd or fraction thereof up to 500,000 gpd and \$1000 per 500,000 gpd or fraction thereof for flows above 500,000 gpd. Therefore, the permit fee for this proposed transfer is \$7000 and is attached to this submittal.

The City was grandfathered an inter-basin transfer permit at a rate of 1.1 MGD. Projections of inter-basin transfers have been taken utilizing calendar year 2008 as the base year. The City of Crossville Inter-Basin Water Transfer Report of 2009 reported a maximum ninety day period transfer of 2.016 MGD from the Upper Cumberland River Basin to the Upper Tennessee- Clinch/Emory River Basin.

The City of Crossville water system operates two water treatment facilities; one on Meadow Park Lake and one on Lake Holiday. Due to its geographic location at the top of the Tennessee Divide, the City cannot avoid performing inter-basin transfers. The Crossville water system withdraws water in two basins. The Meadow Park Lake is located in the Upper Cumberland Basin and Lake Holiday is located in the Upper Tennessee -Clinch/Emory River Basin. The City's distribution system has customers within each basin as well as a wholesale customer, Grandview Utility District, which has customers within the Lower Tennessee-Hiwassee River Basin.

The historical growth of the distribution system has been such that the majority of the customers of the system are located within the Upper Tennessee -Clinch/Emory River Basin. The City's construction of the Meadow Park water treatment plant in 1938 created the first documentable inter-basin transfer. The City of Crossville Water System has been performing the transfer activity requested in this permit application since 1938.

SECTION 1. REQUIRED INFORMATION

1.1. Volume of the proposed withdrawal and the proposed transfer stated in gallons per day that the applicant seeks to be authorized.

The City of Crossville is seeking authorization for the transfer of up to 3.5 MGD. This transfer has a grandfathered permit established with a transfer limit of 1.1 MGD. The 2009 Inter-Basin Transfer Report made by the City of Crossville shows that the transfer has reached 2.016 MGD based on the latest available data. The transfer for which this permit is requested is an ongoing activity and existed prior to the passage of the Tennessee Inter-Basin Water Transfer Act.

Please note that all volumes described within this application are based on the average daily transfer amount calculated for the highest continuous 90-day period reported in units of gallons per day as required by the regulations and the Tennessee Inter-Basin Water Transfer Act. Actual measured flows on any given day may exceed or fail to reach the flow volumes contained within the permit application.

1.2. Identification of all of the withdrawal, return, and transfer points.

The City of Crossville is located on the Cumberland Plateau of eastern Tennessee. The water system serves areas of the Cumberland Plateau in three distinct regulatory basins defined in the Inter-Basin Transfer Permit Act of the State of Tennessee. The three basins are the Upper Tennessee – Clinch/Emory River Basin, the Lower Tennessee – Hiwassee River Basin, and the Upper Cumberland River Basin. It is not uncommon for the pipes in the City of Crossville water distribution system to cross a basin boundary several times along a basin border. Many of the main roads within the geographical area are located on the divide or in close proximity to the divide between basins. Consequently, it is impractical to permit a transfer each time the pipe crosses the basin limits.

In addition, the City of Crossville has surface water sources in two of these three basins. The City of Crossville's Lake Holiday Water Treatment Plant withdraws water from Lake Holiday; an impoundment constructed in the early 1960s on the Obed River. The Obed River is within the Upper Tennessee – Clinch/Emory River Basin. The City of Crossville's Meadow Park Water Treatment Plant withdraws water from Meadow Park Lake; an impoundment constructed in 1938 on Meadow Creek. Meadow Creek is within the Upper Cumberland River Basin.

The City of Crossville has proposed a third surface water source; obtained funding for the construction, and is beginning implementation to construct a system to utilize the third water source. The third water source is Lake Tansi; a 405 acre man-made impoundment within the Upper Tennessee – Clinch/Emory River Basin. The water from this impoundment is proposed to be transferred under separate permit from the basin of origin into the Upper Cumberland River Basin for treatment at the Meadow Park Water Treatment Plant. The majority of this transfer will be returned to the Upper Tennessee – Clinch/Emory River Basin for distribution to customers via this permit application.

This proposed permit is requested to cover transfer of surface water from the Lake Holiday Water Treatment Plant and Lake Holiday or for water already transferred into the Upper Tennessee River Basin from the Upper Cumberland River Basin; sourced from the Meadow Park Water Treatment Plant from the Meadow Park Lake or the proposed withdrawal at Lake Tansi to

the customers of the City of Crossville and its wholesale customers which are located in the Upper Tennessee – Hiwassee River Basin.

Attached to this application is a water distribution system map which shows the general location of the piping systems within the City of Crossville water system. The map identifies the location of the City of Crossville's two withdrawal points, one proposed withdrawal point, and the points at which piping systems cross basin boundaries.

1.3. The volume of water that will be returned to the basin of origin or downstream basin.

Portions of the water transferred under this permit are transferred to the South Cumberland Utility District, the City of Crossville, and other entities that transfer a portion of the water back into the basin of origin. The City of Crossville water system is projected to return up to 53,000 gpd of the permit volume to the basin of origin while the South Cumberland Utility District is projected to return up to 139,000 gallons of the transfer back to the basin of origin.

In summary, projections indicate that approximately 6 to 8.5% of the actual transfer volume will be returned to the basin of origin; or approximately 210,000 gpd to 290,000 gpd.

The receiving basin for this activity is not a downstream basin of the basin of origin and none of the transfer volume will be returned to a downstream basin of the basin of origin.

1.4. The peak capacity of each major component in the proposed withdrawal and transfer facilities.

The peak capacity of the Meadow Park Water Treatment Plant controls the peak capacity of the existing withdrawal at Meadow Park Lake. The current peak operational capacity of the Meadow Park Water Treatment Plant is 3.5 MGD.

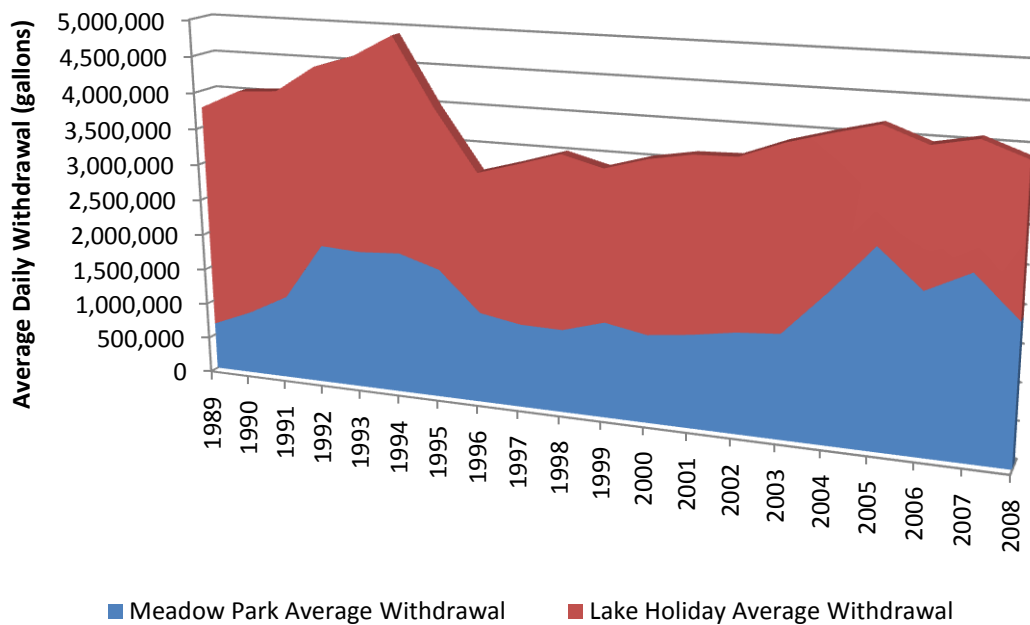
The peak capacity of the Lake Holiday Water Treatment Plant controls the peak capacity of the existing withdrawal at Lake Holiday. The current peak operational capacity of the Lake Holiday Water Treatment Plant is 4.0 MGD.

The historical withdrawal from each of the two water sources used by the City of Crossville is summarized for the last twenty year period in the table and graph below.

Year	Meadow Park Average Withdrawal (gallons)	Meadow Park Percentage of Total Withdrawal	Lake Holiday Average Withdrawal (gallons)	Lake Holiday Percentage of Total Withdrawal	Total Average Withdrawal (gallons)
1989	661,490	17.5%	3,108,318	82.5%	3,769,808
1990	885,240	22.0%	3,144,203	78.0%	4,029,442
1991	1,171,511	28.8%	2,895,274	71.2%	4,066,785
1992	1,960,361	44.3%	2,469,486	55.7%	4,429,847
1993	1,929,718	41.9%	2,675,586	58.1%	4,605,304
1994	1,965,819	40.0%	2,946,321	60.0%	4,912,140
1995	1,794,099	45.1%	2,181,151	54.9%	3,975,249
1996	1,252,385	39.5%	1,915,167	60.5%	3,167,551
1997	1,152,797	34.6%	2,177,819	65.4%	3,330,616
1998	1,143,214	32.6%	2,362,340	67.4%	3,505,553
1999	1,309,345	38.9%	2,052,373	61.1%	3,361,718

2000	1,204,361	34.1%	2,323,609	65.9%	3,527,970
2001	1,273,553	35.1%	2,354,088	64.9%	3,627,641
2002	1,368,953	37.6%	2,275,830	62.4%	3,644,783
2003	1,416,608	36.7%	2,447,877	63.3%	3,864,485
2004	2,015,336	50.1%	2,010,858	49.9%	4,026,194
2005	2,666,332	63.9%	1,505,112	36.1%	4,171,444
2006	2,157,282	54.4%	1,804,759	45.6%	3,962,041
2007	2,447,433	60.0%	1,629,553	40.0%	4,076,986
2008	1,895,213	49.0%	1,975,858	51.0%	3,871,071

City of Crossville Water System Average Daily Withdrawals by Year and Source



The proposed transfer is performed through the City of Crossville Water System distribution piping. The piping system is complex but is shown on the attached system map.

The transfer occurs on the high service main shortly after leaving the Meadow Park Water Treatment Plant. Therefore, the maximum transfer is limited by the capacity of the Meadow Park Water Treatment Plant.

1.5. Engineering and economic justification for the capacity of each major component of the proposed withdrawal and transfer facilities.

The transfer of water from the Upper Cumberland River Basin to the Upper Tennessee-Clinch/Emory River Basin is already occurring and is a grandfathered activity. Transfers have exceeded the originally authorized volume by the Tennessee Department of Environment and Conservation.

The economic and environmental impacts associated with development of any alternate facility would involve the expenditure of additional capital funds for the development and permitting of a water resource, construction of treatment works, and construction of modifications to the existing distribution system. It is unfeasible to expend capital resources to replace the Meadow Park Water Treatment Plant and Meadow Park Lake to avoid the proposed transfer volume.

1.6. An assessment of the hydraulic and environmental impacts of the withdrawal on the losing river.

The losing river basin for this permit is the Upper Cumberland River Basin. Based on all of the City of Crossville's withdrawals for drinking water and discharges into the different basins, the ultimate losing basin is the Upper Cumberland River Basin. The Upper Tennessee – Clinch/Emory River Basin has a net gain of water from the operation of the City of Crossville Water System.

The City of Crossville's proposed Water Harvesting Project has as a primary goal to help balance the net transfers in the City of Crossville Water System. Although, the project will require a Inter-Basin Transfer Permit to transfer the water into the Upper Cumberland River Basin for treatment at the Meadow Park Water Treatment Plant. Approximately 93% of the water transferred from Lake Tansi will be transferred via this permit back into the Upper Tennessee – Clinch/Emory River Basin.

The transfers and net loss out of the Upper Cumberland River Basin has been occurring since 1938 when the Meadow Park Water Treatment Plant was constructed for the City of Crossville Water System. The fact that this has been occurring since before the existence of any significant environmental laws results in a lack of adequate accurate historical records to document any hydraulic and environmental impacts.

The hydraulic impacts associated with the construction of the Meadow Park Dam and subsequent use of the water by the City of Crossville, along with any inferred environmental impacts, can be estimated on the basis of minimum stream flows. However, any environmental impacts from the loss of this stream flow occurred long ago.

The United States Geological Survey StreamStats system was used to estimate streamflow statistics for Meadow Creek under the assumption that the Meadow Park Dam is not present. The low flow statistics for Meadow Creek under this assumption is a 3Q2 flow of 0.03 cfs, a 3Q10 of 0.01 cfs, a 3Q20 of 0.00 cfs, and a 7Q10 of 0.01 cfs. These low flow statistics indicate minimal flows are present within the original drainage basin. The construction of the Meadow Park Dam has eliminate all low flows for the low flow periods. Current data taken by the City of Crossville describing the pool level in Meadow Park Lake indicate that the current low flow statistic is 0.00 cfs for all standard low flow statistics. This proposed permit obviously will not lower the low flow values and therefore will not alter the support of stream uses that are tied to low flow conditions.

The National Park Service has expressed a concern on the increase of flow in the Obed River below Crossville. The net transfer into this basin from the Upper Cumberland River Basin has in the past contributed to this increase of flow.

The nearest downstream stream gauge for each of the City of Crossville's two existing withdrawal locations, Meadow Park Lake and Lake Holiday, and for the proposed withdrawal

location, Lake Tansi have been checked for the availability of historical data using the StreamStats v2 system of the U.S. Geological Survey.

The nearest downstream stream gauge for Meadow Park Lake is the gauge at 35.8911776 north latitude and -85.2180214 west longitude referred to as USGS Station Number 03418500 named **Caney Fork at Clifty**. The gauge has data for the period of 1931 to 1949. Please note that this gauge data includes some data from before the construction of Meadow Park Dam in 1938 although much of the data was taken during significant drought periods on the Cumberland Plateau. Only the years of 1937, 1942, 1945, 1948, and 1949 had precipitation above normal during the period from 1931 to 1949 on the Cumberland Plateau. Therefore, there is only 5 years in which there was above normal rainfall in the gauge data and 14 years of below normal rainfall. During the period of 1931 to 1949, the Cumberland Plateau Area had a rainfall deficit in excess of 73 inches below normal. The data from the stream gage is summarized in the table below.

The nearest downstream stream gauge for Lake Holiday is the gauge at 36.0814937 north latitude and -84.6703113 west longitude referred to as USGS Station Number 03539800 named **Obed River Near Lancing, TN**. The gauge has data for the periods of 1956-68, 1973-1987, and 1999-2004. Please note that this gauge data includes a small amount of data from before the construction of Lake Holiday Dam. The data is summarized in the table below.

The nearest downstream stream gauge for Lake Tansi is the gauge at 35.89042468 north latitude and -84.9378241 west longitude referred to as USGS Station Number 03539000 named **Daddys Ck near Grassy Cove Tenn**. The gauge has data for the period of 1925 to 1930. Please note that this gauge data includes data from before the construction of Lake Tansi although much of the data was taken during significant drought periods on the Cumberland Plateau. The data is summarized in the table below.

Parameter	USGS Station Number 03418500	USGS Station Number 03539800	USGS Station Number 03539000
Station Name	Caney Fork at Clifty, TN	Obed River Near Lancing, TN	Daddys Ck Nr Grassy Cover, TN
Period of Record	1931-49	1956-68,1973-87, 1999-2004	1925-30
Contributing Drainage Area	111.00 square miles	518.00 square miles	Unpublished
Average daily streamflow	213.17 cfs	1006.94 cfs	138.03 cfs
1 Percentile Flow	2220.4 cfs	9627.0 cfs	1385.2 cfs
5 Percentile Flow	847.0 cfs	3792.5 cfs	495.7 cfs
10 Percentile Flow	507.7 cfs	2340.0 cfs	303.6 cfs
20 Percentile Flow	292.0 cfs	1350.0 cfs	179.0 cfs
25 Percentile Flow	233.0 cfs	1100.0 cfs	151.0 cfs
30 Percentile Flow	192.0 cfs	900.0 cfs	121.0 cfs
40 Percentile Flow	122.0 cfs	598.0 cfs	86.0 cfs
50 Percentile Flow	64.0 cfs	382.0 cfs	62.0 cfs
60 Percentile Flow	28.0 cfs	211.0 cfs	40.0 cfs
70 Percentile Flow	11.0 cfs	98.0 cfs	20.3 cfs
75 Percentile Flow	7.6 cfs	67.0 cfs	13.0 cfs
80 Percentile Flow	4.6 cfs	45.0 cfs	7.47 cfs



90 Percentile Flow	1.13 cfs	18.0 cfs	1.8 cfs
95 Percentile Flow	0.4 cfs	8.4 cfs	0.2 cfs
99 Percentile Flow	0.1 cfs	1.9 cfs	0.0 cfs

Withdrawal from Meadow Park Lake can be up to 3.5 MGD (5.42 cfs) based on the design capacity of the Meadow Park Water Treatment Plant. Assuming that the flow data from the gage at Clifty, TN on the Caney Fork is representative of average flows conditions, the design withdrawal from Meadow Park Lake would reduce the average daily streamflow in the Caney Fork River at Clifty from 213.2 cfs to 207.8 cfs; constituting a 2.54% reduction in the average flow.

Withdrawal from Lake Holiday can be up to 4.0 MGD (6.19 cfs) based on the design capacity of the Lake Holiday Water Treatment Plant. Assuming that the flow data from the gage on the Obed River near Lancing, Tn is representative of average flow conditions, the design withdrawal from Lake Holiday would reduce the average daily streamflow in the Obed River near Lancing from 1006.9 cfs to 1000.7 cfs; constituting a 0.61% reduction in the average flow.

The National Park Service has performed an environmental analysis of the impact of withdrawals from Lake Tansi on the river basin. A detailed analysis as part of the Section 7 Review and Determination under the Wild and Scenic Rivers Act has been performed by the National Park Service on the effects that the proposed withdrawal from Lake Tansi would have on the Obed Wild and Scenic River and a main tributary, Daddy's Creek. The analysis was performed for the Lake Tansi Water Harvesting Project. The findings from the National Park Service state, "In short, we have determined that, as proposed, the project is not likely to unreasonably diminish the value for which the Obed Wild and Scenic River is designated to protect." The detailed report finds, "The hydrological analysis concludes that the watershed contributing flow to Lake Tansi produces an estimated 2.1 to 3.3 percent of the Daddys Creek flow at the OWSR boundary. A reduction in flow by this amount, as the report states, would be difficult to measure at a standard USGS streamgage or using standard USGS/NPS discharge measurement techniques." The analysis further concludes, "the proposed water harvesting project has minimal potential to affect assimilative capacities for analytical parameters representing general water quality conditions." The proposed water harvesting project is expected to reduce the mean annual flow in Daddys Creek at the OBRI boundary by 2.97 percent.

1.7. An engineering, environmental, and economic assessment of the feasibility of utilizing alternative water sources by the water system in the receiving basin.

The development of alternative water sources has not been examined in detail as it represents an unfeasible option based on the capital funding requirements necessary to eliminate the Meadow Park Water Treatment Plant and the Meadow Park Lake. Engineering, environmental, and economic assessment of alternatives to expanding Meadow Park Lake have been investigated. The details of the evaluations can be found in the attached City of Crossville Raw Water Supply Expansion Engineering Report by Environmental & Civil Engineering Services.

1.8. A listing of conservation programs or practices occurring or proposed of the system in the receiving river basin.

As stated previously, the inter basin transfer is ongoing and has been a grandfathered activity authorized by the Tennessee Department of Environment and Conservation. In 2008, the City of

Crossville began a major reinvestment program to reduce the system's water loss as the first step toward major conservation of water. The program is examining losses due to flushing operations, unmetered water resulting from age and deterioration of meters, and losses due to piping materials. The program will take at least three years to complete and has a goal of reducing the City's water loss to an estimated 15 to 17%. This will ultimately represent approximately a 10% reduction in the raw water withdrawn by the City of Crossville.

In addition, the City of Crossville has worked jointly with local industries that are large consumers within their water system to define opportunities to reduce water consumption, opportunities for water reuse, and methods to minimize wastewater discharges. The City in cooperation with these industries has been able to significantly reduce the total water consumption by industries and their wastewater discharges.

The water transferred as a result of this permit is delivered to the Grandview Utility District which has neither the labor nor financial resources to commit to any large scale conservation program. Since the total water consumption of the Grandview Utility District is not a significant fraction of the water withdrawn by the City of Crossville, conservation programs aimed at the reduction of water consumption in the Grandview Utility District will only yield total reductions which are a small fraction of what conservation programs within the City of Crossville system is capable of obtaining. Therefore, the City of Crossville should focus on reductions in its own system prior to assisting the Grandview Utility District with obtaining effective conservation measures within its boundaries.

No additional conservation programs are currently proposed for the continuation of this activity.

1.9. The proposed date upon which the water transfer is to commence.

The transfer activity has been occurring since before the passage of the Tennessee Inter-Basin Water Transfer Act and is ongoing. No plans exist at the current time to eliminate this Inter-Basin Transfer.

1.10. Purpose and justification for the proposed transfer.

The City of Crossville Facilities Plan, which encompasses the twenty year period from 2009-2029, estimates an average annual growth rate for demand on the City water system of 3.2%.

The projected 20-year raw water demand as stated in the City of Crossville Facilities Plan is 7.54 million gallons per day. This includes the 2.016 MGD reported by the Inter-Basin Transfer Report of 2009 for the Upper Cumberland River Basin to the Upper Tennessee -Clinch/Emory River Basin.

Since the grandfathered limits have been exceeded, it is necessary that the City seek modification of the grandfathered permit. The purpose of the proposed transfer is to continue to provide potable drinking water to the customers of the City of Crossville Water System.

1.11. Any other appropriate information.

Population forecasts for this study have been based on a sustained average growth rate of 2.5%. This projection is based upon a report by the University of Tennessee Institute for Public Service and Institute of Agriculture entitled *The Long Term Impacts of Retiree In-Migration on Rural Areas: A Case Study of Cumberland County, Tennessee* in September 2007. The report shows

that Cumberland County has had a sustained average growth rate of 2.63% on an annual average basis for the period of 1970 through 2004.

The project Facilities Plan estimates that the growth rate for demand on the City of Crossville water system is a sustained average annual growth rate of 3.2%.

Attachments: Water System Map

City of Crossville Raw Water Supply Expansion Engineering Report

Permit Application Fee Check in the amount of \$7000

Technical Memo on City of Crossville Inter-Basin Transfers

1.12. Approval to Submit Application:

I hereby approve submittal of this application to the State of Tennessee, Department of Environment and Conservation for the City of Crossville.

Mr. Ted Meadows
City Manager